

Amendments to the Claims

This listing of claims will replace all prior versions and listings of claims in the application.

1. (Previously Presented) An isolated nucleic acid molecule encoding an odorant receptor protein, wherein the receptor protein comprises seven transmembrane domains and a 17-amino acid cytoplasmic loop between the fifth and sixth transmembrane domains, and is further characterized by at least one of the following characteristics:
 - (a) the loop between the first transmembrane domain and the second transmembrane domain, and the second transmembrane domain together comprise consecutive amino acids having the following sequence: -L, X, X, P, M, Y, X, F, L- (SEQ ID NO: 55);
 - (b) the third transmembrane domain, and the loop between the third transmembrane domain and the fourth transmembrane domain together comprise consecutive amino acids having one of the following sequences:

-M, X, Y, D, R, X, X, A, I, C- (SEQ ID NO: 57); or

-D, R, X, X, A, I, C- (SEQ ID NO: 59);
 - (c) the loop between the fifth transmembrane domain and the sixth transmembrane domain, and the sixth transmembrane domain together comprise consecutive amino acids having

one of the following sequences:

-K or R, X, F, S, T, C, X, S, H- (SEQ ID NO: 61); or

-F, S, T, C, X, S, H- (SEQ ID NO: 63); or

- (d) the seventh transmembrane domain and the C-terminal domain together comprise consecutive amino acids having one of the following sequences:

-P, X, X, N, P, X, I, Y, X, L, R, N- (SEQ ID NO: 65);

or

-P, X, X, N, P, X, I, Y- (SEQ ID NO: 67); or

-N, P, X, I, Y, X, L, R, N- (SEQ ID NO: 69);

wherein X is any amino acid.

2. (Original) The isolated nucleic acid molecule of claim 1 wherein:

- (a) the loop between the first transmembrane domain and the second transmembrane domain, and the second transmembrane domain together comprise consecutive amino acids having the following sequence:

-L, H or Q, K or M or T, PMY, F or L, FL- (SEQ ID NO: 56);

- (b) the third transmembrane domain, and the loop between the third transmembrane domain and the fourth transmembrane domain together comprise consecutive amino acids having one of the following sequences:

-M, A or S, YDR, F or Y, L or V, AIC- (SEQ ID NO: 58); or

-DR, F or Y, L or V, AIC- (SEQ ID NO: 60);

- (c) the loop between the fifth transmembrane domain and the sixth transmembrane domain, and the sixth transmembrane domain together comprise consecutive amino acids having one of the following sequences:

-K or R, A or I or S or V, FSTC, A or G or S, SH- (SEQ ID NO: 62); or

-FSTC, A or G or S, SH- (SEQ ID NO: 64); or

- (d) the seventh transmembrane domain and the C-terminal domain together comprise consecutive amino acids having one of the following sequences:

-P, M or L or V, F or L or V, NP, F or I, IY, C or S or T, LRN- (SEQ ID NO: 66); or

-P, M or L or V, F or L or V, NP, F or I, IY- (SEQ ID NO: 68); or

-NP, F or I, IY, C or S or T, LRN- (SEQ ID NO: 70).

3. (Original) The isolated nucleic acid molecule of claim 1, wherein the receptor protein is characterized by at least two of the characteristics (a) through (d).
4. (Original) The isolated nucleic acid molecule of claim 1, wherein the receptor protein is characterized by at least three of the characteristics (a) through (d).
5. (Original) The isolated nucleic acid molecule of claim 1, wherein the receptor protein is characterized by all of the characteristics (a) through (d).
6. (Previously Presented) An isolated nucleic acid molecule encoding an odorant receptor protein comprising seven transmembrane domains and a 17-amino acid cytoplasmic loop between the fifth and sixth transmembrane domains, wherein the nucleic acid molecule encodes a protein selected from the group consisting of:
 - (a) an odorant receptor protein comprising consecutive amino acids having a sequence identical to that beginning with methionine at position 1 and ending with tyrosine at position 333 as set forth in row F3 of Figures 4A to 4M (SEQ ID NO: 71),
 - (b) an odorant receptor protein comprising consecutive amino acids having a sequence identical to that beginning with methionine at position 1 and ending with glutamine at position 313 as set forth in row F5 of Figures 4A to 4L

(SEQ ID NO: 72),

- (c) an odorant receptor protein comprising consecutive amino acids having a sequence identical to that beginning with methionine at position 1 and ending with lysine at position 311 as set forth in row F6 of Figures 4A to 4L (SEQ ID NO: 73),
- (d) an odorant receptor protein comprising consecutive amino acids having a sequence identical to that beginning with methionine at position 1 and ending with glycine at position 317 as set forth in row F12 of Figures 4A to 4L (SEQ ID NO: 74),
- (e) an odorant receptor protein comprising consecutive amino acids having a sequence identical to that beginning with methionine at position 1 and ending with leucine at position 310 as set forth in row I3 of Figures 4A to 4L (SEQ ID NO: 75),
- (f) an odorant receptor protein comprising consecutive amino acids having a sequence identical to that beginning with methionine at position 1 and ending with glycine at position 327 as set forth in row I7 of Figures 4A to 4L (SEQ ID NO: 76),
- (g) an odorant receptor protein comprising consecutive amino acids having a sequence identical to that beginning with methionine at position 1 and ending with tryptophan at position 312 as set forth in row I8 of Figures 4A to 4L

(SEQ ID NO: 77),

- (h) an odorant receptor protein comprising consecutive amino acids having a sequence identical to that beginning with methionine at position 1 and ending with leucine at position 314 as set forth in row I9 of Figures 4A to 4L (SEQ ID NO: 78),
- (i) an odorant receptor protein comprising consecutive amino acids having a sequence identical to that beginning with methionine at position 1 and ending with leucine at position 312 as set forth in row I14 of Figures 4A to 4L (SEQ ID NO: 79),
- (j) an odorant receptor protein comprising consecutive amino acids having a sequence identical to that beginning with methionine at position 1 and ending with leucine at position 314 as set forth in row I15 of Figures 4A to 4L (SEQ ID NO: 80); and
- (k) an odorant receptor protein that shares from 40-80% amino acid identity with any one of the proteins of (a)-(j), comprises seven transmembrane domains, and is further characterized by at least one of the following characteristics:
 - (i) the loop between the first transmembrane domain and the second transmembrane domain, and the second transmembrane domain together comprise consecutive amino acids having the following sequence: -L, X,

X, P, M, Y, X, F, L- (SEQ ID NO: 55);

(ii) the third transmembrane domain, and the loop between the third transmembrane domain and the fourth transmembrane domain together comprise consecutive amino acids having one of the following sequences:

-M, X, Y, D, R, X, X, A, I, C- (SEQ ID NO: 57); or

-D, R, X, X, A, I, C- (SEQ ID NO: 59);

(iii) the loop between the fifth transmembrane domain and the sixth transmembrane domain, and the sixth transmembrane domain together comprise consecutive amino acids having one of the following sequences:

-K or R, X, F, S, T, C, X, S, H- (SEQ ID NO: 61); or

-F, S, T, C, X, S, H- (SEQ ID NO: 63); or

(iv) the seventh transmembrane domain and the C-terminal domain together comprise consecutive amino acids having one of the following sequences:

-P, X, X, N, P, X, I, Y, X, L, R, N- (SEQ ID NO: 65); or

-P, X, X, N, P, X, I, Y- (SEQ ID NO: 67); or
-N, P, X, I, Y, X, L, R, N- (SEQ ID NO: 69);
wherein X is any amino acid.

7. (Original) The isolated nucleic acid molecule of claim 6
wherein:

(i) the loop between the first transmembrane domain and the
second transmembrane domain, and the second transmembrane
domain together comprise consecutive amino acids having
the following sequence:

-L, H or Q, K or M or T, PMY, F or L, FL- (SEQ ID NO:
56);

(ii) the third transmembrane domain, and the loop between the
third transmembrane domain and the fourth transmembrane
domain together comprise consecutive amino acids having
one of the following sequences:

-M, A or S, YDR, F or Y, L or V, AIC- (SEQ ID NO: 58); or

-DR, F or Y, L or V, AIC- (SEQ ID NO: 60);

(iii) the loop between the fifth transmembrane domain and the
sixth transmembrane domain, and the sixth transmembrane
domain together comprise consecutive amino acids having

one of the following sequences:

-K or R, A or I or S or V, FSTC, A or G or S, SH- (SEQ ID NO: 62); or

-FSTC, A or G or S, SH- (SEQ ID NO: 64); or

(iv) the seventh transmembrane domain and the C-terminal domain together comprise consecutive amino acids having one of the following sequences:

-P, M or L or V, F or L or V, NP, F or I, IY, C or S or T, LRN- (SEQ ID NO: 66); or

-P, M or L or V, F or L or V, NP, F or I, IY- (SEQ ID NO: 68); or

-NP, F or I, IY, C or S or T, LRN- (SEQ ID NO: 70).

8. (Previously Presented) An isolated nucleic acid molecule encoding an odorant receptor protein comprising seven transmembrane domains and a 17-amino acid cytoplasmic loop between the fifth and sixth transmembrane domains, wherein the nucleic acid molecule comprises a nucleic acid sequence which can be amplified by polymerase chain reaction using:

(a) any one of 5' primers A1 (SEQ ID NO: 37), A2 (SEQ ID NO: 38), A3 (SEQ ID NO: 39), A4 (SEQ ID NO: 40), or A5 (SEQ

ID NO: 41); and

(b) any one of 3' primers B1 (SEQ ID NO: 42), B2 (SEQ ID NO: 43), B3 (SEQ ID NO: 44), B4 (SEQ ID NO: 45), B5 (SEQ ID NO: 46), or B6 (SEQ ID NO: 47).

9-12. (Canceled)

13. (Original) The isolated nucleic acid molecule of any one of claims 1, 6, 8, or 9, wherein the odorant receptor is a vertebrate odorant receptor.
14. (Original) The isolated nucleic acid molecule of claim 13, wherein the vertebrate odorant receptor is a fish odorant receptor or a mammalian odorant receptor.
15. (Original) The isolated nucleic acid molecule of claim 14, wherein the mammalian odorant receptor is a human odorant receptor, a rat odorant receptor, a mouse odorant receptor or a dog odorant receptor.
16. (Original) The isolated nucleic acid molecule of claim 1, 6, 8, or 9, wherein the nucleic acid is DNA.
17. (Original) The isolated nucleic acid molecule of claim 16, wherein the DNA is cDNA.
18. (Original) A vector comprising the isolated nucleic acid

molecule of claim 1, 6, 8, or 9.

19. (Original) The vector of claim 18, wherein the vector additionally comprises elements necessary for replication and expression in a suitable host.
20. (Canceled)
21. (Original) A cell transfected with the vector of claim 19.
22. (Original) The cell of claim 21, wherein the cell is an olfactory cell.
23. (Original) The cell of claim 21, wherein the cell is a non-olfactory cell.
24. (Original) The cell of claim 23, wherein prior to being transfected with the vector the non-olfactory cell does not express an odorant receptor protein.
- 25-63. (Canceled)
64. (Previously Presented) An isolated nucleic acid molecule encoding an odorant receptor protein comprising seven transmembrane domains and a 17-amino acid cytoplasmic loop between the fifth and sixth transmembrane domains, wherein the nucleic acid molecule comprises:

- (a) a nucleic acid sequence given in any one of Figures 9 to 18 (SEQ ID NOS.: 1-10); or
 - (b) a nucleic acid sequence degenerate to a sequence of (a) as a result of the genetic code.
- 65. (Previously Presented) An isolated nucleic acid molecule encoding an odorant receptor protein comprising seven transmembrane domains and a 17-amino acid cytoplasmic loop between the fifth and sixth transmembrane domains, wherein the nucleic acid molecule comprises:
 - (a) a nucleic acid sequence given in any one of the Figures 19 to 31 (SEQ ID NOS.: 11, 13, 15, 17, 19, 21, 23, 25, 27, 29, 31, 33, or 35); or
 - (b) a nucleic acid sequence degenerate to a sequence of (a) as a result of the genetic code.
- 66. (New) A purified odorant receptor protein, wherein the receptor protein comprises seven transmembrane domains and a 17-amino acid cytoplasmic loop between the fifth and sixth transmembrane domains, and is further characterized by at least one of the following characteristics:
 - (a) the loop between the first transmembrane domain and the second transmembrane domain, and the second transmembrane domain together comprise consecutive amino acids having

the following sequence: -L, X, X, P, M, Y, X, F, L- (SEQ ID NO: 55);

- (b) the third transmembrane domain, and the loop between the third transmembrane domain and the fourth transmembrane domain together comprise consecutive amino acids having one of the following sequences:

-M, X, Y, D, R, X, X, A, I, C- (SEQ ID NO: 57); or

-D, R, X, X, A, I, C- (SEQ ID NO: 59);

- (c) the loop between the fifth transmembrane domain and the sixth transmembrane domain, and the sixth transmembrane domain together comprise consecutive amino acids having one of the following sequences:

-K or R, X, F, S, T, C, X, S, H- (SEQ ID NO: 61); or

-F, S, T, C, X, S, H- (SEQ ID NO: 63); or

- (d) the seventh transmembrane domain and the C-terminal domain together comprise consecutive amino acids having one of the following sequences:

-P, X, X, N, P, X, I, Y, X, L, R, N- (SEQ ID NO: 65); or

-P, X, X, N, P, X, I, Y- (SEQ ID NO: 67); or

-N, P, X, I, Y, X, L, R, N- (SEQ ID NO: 69);

wherein X is any amino acid.

67. (New) A purified odorant receptor protein comprising seven transmembrane domains and a 17-amino acid cytoplasmic loop between the fifth and sixth transmembrane domains, wherein the protein is selected from the group consisting of:

- (a) an odorant receptor protein comprising consecutive amino acids having a sequence identical to that beginning with methionine at position 1 and ending with tyrosine at position 333 as set forth in row F3 of Figures 4A to 4M (SEQ ID NO: 71),
- (b) an odorant receptor protein comprising consecutive amino acids having a sequence identical to that beginning with methionine at position 1 and ending with glutamine at position 313 as set forth in row F5 of Figures 4A to 4L (SEQ ID NO: 72),
- (c) an odorant receptor protein comprising consecutive amino acids having a sequence identical to that beginning with methionine at position 1 and ending with lysine at position 311 as set forth in row F6 of Figures 4A to 4L (SEQ ID NO: 73),
- (d) an odorant receptor protein comprising consecutive amino acids having a sequence identical to that beginning with methionine at position 1 and ending with glycine at position 317 as set forth in row F12 of Figures 4A to 4L

(SEQ ID NO: 74),

- (e) an odorant receptor protein comprising consecutive amino acids having a sequence identical to that beginning with methionine at position 1 and ending with leucine at position 310 as set forth in row I3 of Figures 4A to 4L (SEQ ID NO: 75),
- (f) an odorant receptor protein comprising consecutive amino acids having a sequence identical to that beginning with methionine at position 1 and ending with glycine at position 327 as set forth in row I7 of Figures 4A to 4L (SEQ ID NO: 76),
- (g) an odorant receptor protein comprising consecutive amino acids having a sequence identical to that beginning with methionine at position 1 and ending with tryptophan at position 312 as set forth in row I8 of Figures 4A to 4L (SEQ ID NO: 77),
- (h) an odorant receptor protein comprising consecutive amino acids having a sequence identical to that beginning with methionine at position 1 and ending with leucine at position 314 as set forth in row I9 of Figures 4A to 4L (SEQ ID NO: 78),
- (i) an odorant receptor protein comprising consecutive amino acids having a sequence identical to that beginning with methionine at position 1 and ending with leucine at position 312 as set forth in row I14 of Figures 4A to 4L

(SEQ ID NO: 79),

- (j) an odorant receptor protein comprising consecutive amino acids having a sequence identical to that beginning with methionine at position 1 and ending with leucine at position 314 as set forth in row I15 of Figures 4A to 4L (SEQ. ID. NO. 80); and
- (k) an odorant receptor protein that shares from 40-80% amino acid identity with any one of the proteins of (a)-(j), comprises seven transmembrane domains, and is further characterized by at least one of the following characteristics:
 - (i) the loop between the first transmembrane domain and the second transmembrane domain, and the second transmembrane domain together comprise consecutive amino acids having the following sequence: -L, X, X, P, M, Y, X, F, L- (SEQ ID NO: 55);
 - (ii) the third transmembrane domain, and the loop between the third transmembrane domain and the fourth transmembrane domain together comprise consecutive amino acids having one of the following sequences:
 - M, X, Y, D, R, X, X, A, I, C- (SEQ ID NO: 57); or
 - D, R, X, X, A, I, C- (SEQ ID NO: 59);

(iii) the loop between the fifth transmembrane domain and the sixth transmembrane domain, and the sixth transmembrane domain together comprise consecutive amino acids having one of the following sequences:

-K or R, X, F, S, T, C, X, S, H- (SEQ ID NO: 61); or

-F, S, T, C, X, S, H- (SEQ ID NO: 63); or

(iv) the seventh transmembrane domain and the C-terminal domain together comprise consecutive amino acids having one of the following sequences:

-P, X, X, N, P, X, I, Y, X, L, R, N- (SEQ ID NO: 65); or

-P, X, X, N, P, X, I, Y- (SEQ ID NO: 67); or

-N, P, X, I, Y, X, L, R, N- (SEQ ID NO: 69);

wherein X is any amino acid.

68. (New) A purified odorant receptor protein comprising seven transmembrane domains and a 17-amino acid cytoplasmic loop between the fifth and sixth transmembrane domains and encoded by a nucleic acid molecule, wherein the nucleic acid molecule comprises a nucleic acid sequence which can be amplified by polymerase chain reaction using:

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- (a) any one of 5' primers A1 (SEQ ID NO: 37), A2 (SEQ ID NO: 38), A3 (SEQ ID NO: 39), A4 (SEQ ID NO: 40), or A5 (SEQ ID NO: 41); and
- (b) any one of 3' primers B1 (SEQ ID NO: 42), B2 (SEQ ID NO: 43), B3 (SEQ ID NO: 44), B4 (SEQ ID NO: 45), B5 (SEQ ID NO: 46), or B6 (SEQ ID NO: 47).